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Campsites as Products of Physical and Cultural Processes

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Knowledge Assessment II Workshop, Phoenix, AZ

February 1, 2012

U.S. Department of the Interior
U.S. Geological Survey

Purpose of this talk

- Describe progress made towards answering SSQs and fundamental science question
- Describe what we know about the status of campsites and the physical processes acting on them
- Clarify the role of vegetation and other physical and cultural factors affecting campsite quality

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Strategic Science Questions

- SSQ 2-7. Are dam controlled flows affecting TCPs and other tribally-valued resources in the CRE, and if so, in what respects are they being affected, and are those effects considered positive or negative by the tribes who value these resources?
- SSQ 3-7. How do dam controlled flows affect visitors' recreational experiences, and what is/are the optimal flows for maintaining a high quality recreational experience in the CRE?
- SSQ 3-8. What are the drivers for recreational experiences in the CRE, and how important are flows relative to other drivers in shaping recreational experience outcomes?
- SSQ 3-9. How do varying flows positively or negatively affect campsite attributes that are important to visitor experience?
- SSQ 3-10. How can safety and navigability be reliably measured relative to flows?
- SSQ-3-11. How do varying flows positively or negatively affect visitor safety, health, and navigability of the rapids?
- SSQ-12. How do varying flows regimes positively or negatively affect group encounter rates, campsite competition, and other social parameters that are known to be important variables of visitor experience?

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Campsite Monitoring Program Objectives

Annually measure campsite area at the long-term monitoring sites

These objectives specifically target management objective 9.3 of the 2001 GCDAMP strategic plan.

9.3—Increase the size, quality, and distribution of camping beaches in critical and noncritical reaches in the mainstem within the capacity of the Colorado River ecosystem to absorb visitor impacts consistent with National Park Service and tribal river corridor management plans.

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Conclusions

Campsite area decreased from1998 to 2009

Campsite Area decreased during “normal” dam operations (MLFF)

Campsite area increased during High Flow events

Difference between changes in Critical and Non-Critical Reaches – most likely due to vegetation

Operations of the Glen Canyon Dam from 1998 to 2009 did not meet the GCDAMP management objective addressed by this study.

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This study evolved as an adjunct to the long-term sandbar monitoring project that utilizes repeated topographic mapping to quantify changes in sediment storage at selected study sites located throughout the CRE.

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How do we measure campable area?

- Campsite area is defined as a smooth substrate (most commonly sand) with no more than an 8° slope and little or no vegetation.

- Rodmen outline the perimeter of campsite area.

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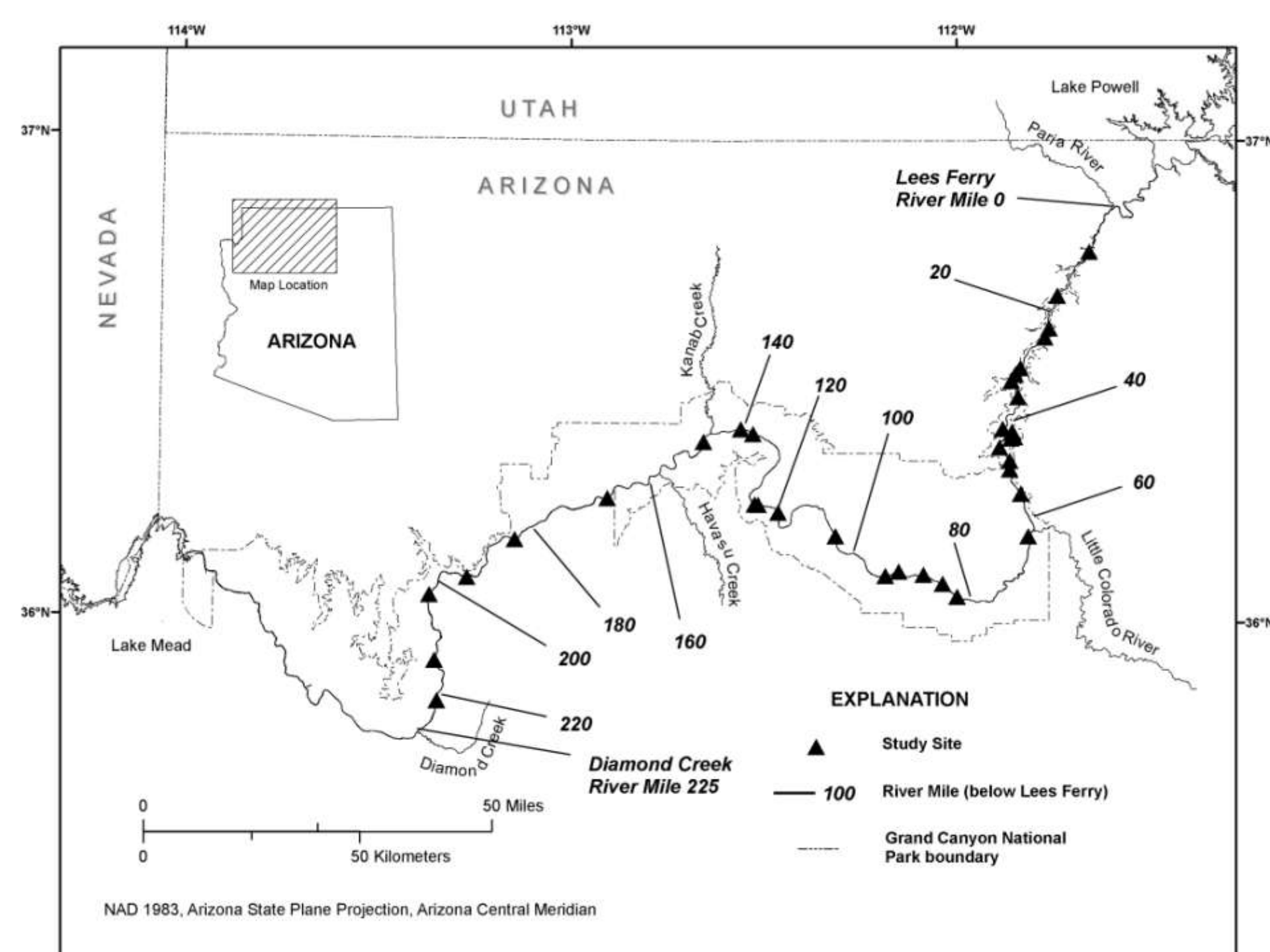
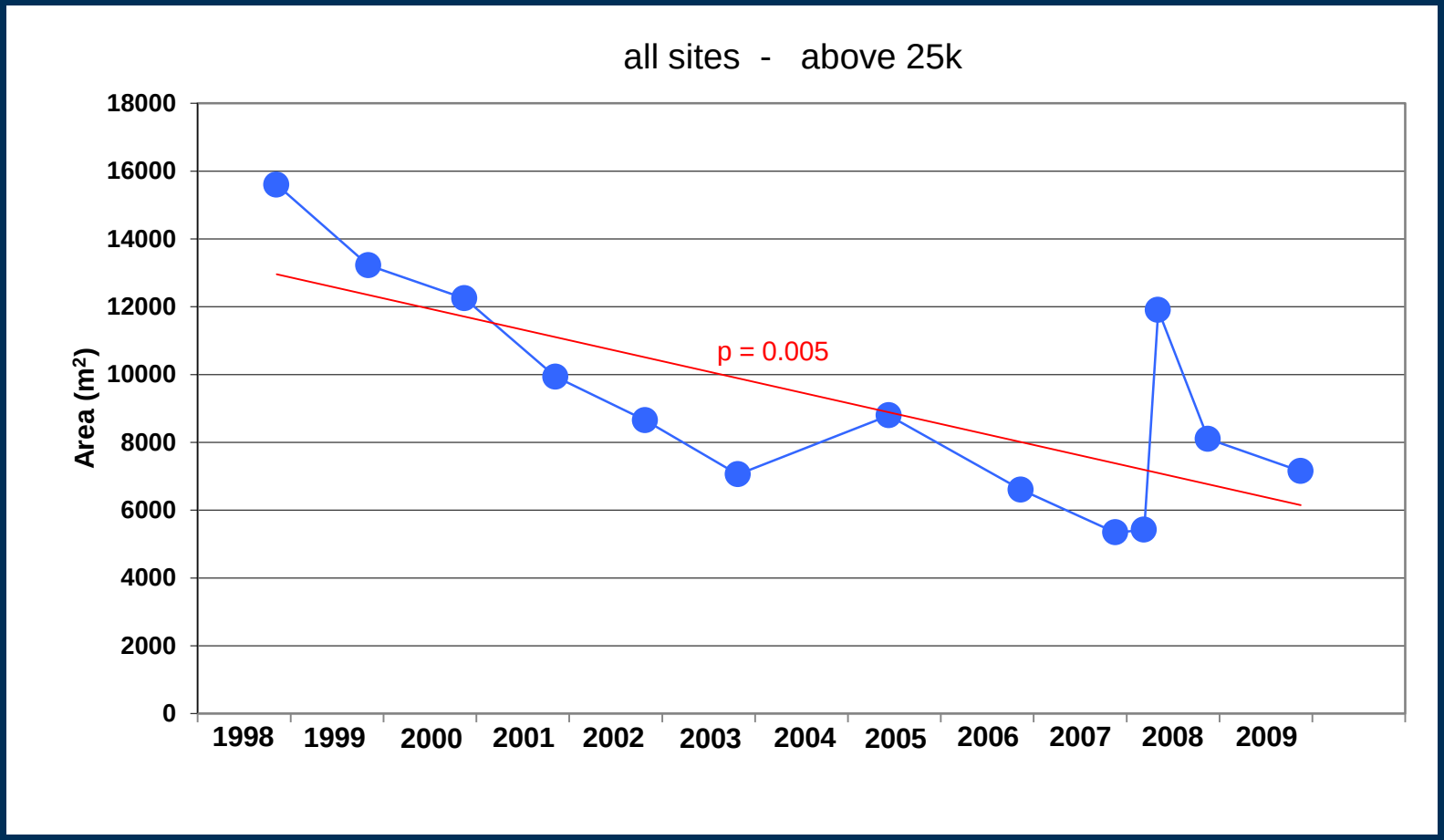

114°W
113°W
112°W
37°N
36°N
UTAH
ARIZONA
NEVADA
Lake Powell
Paria River
Lees Ferry
River Mile 0
20
40
60
80
100
120
140
160
180
200
220
Diamond Creek
River Mile 225
Kanab Creek
Havasu Creek
Little Colorado River
Lake Mead
Diamond Creek
Map Location
ARIZONA
0
50 Miles
0
50 Kilometers
EXPLANATION
Study Site
100
River Mile (below Lees Ferry)
Grand Canyon National Park boundary
NAD 1983, Arizona State Plane Projection, Arizona Central Meridian



Total amount of campsite area – sum of areas for all sites (n=29). Does not include sites added in 2002.

From 1998 to 2009, the total amount of high-elevation campsite area decreased significantly.

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Critical vs. Non Critical Reaches

Schmidt & Graf 1990 (Geomorphic Reaches)		Kearsley et al. 1994 Critical/Non Critical Reaches	
River Mile	**Width**	**River Mile**	**Type**
RM 0-11	W	RM 0-11	NC
RM 11-23	N	RM 11-41	C
RM 23-40	N		
RM 40-62	W	RM 41-76	NC
RM 62-77	W		
RM 77-118	N	RM 76-118	C
RM 118-126	N	RM 116-131	NC
RM 126-140	N	RM 131-139	C
RM 140-160	N	RM 139-164	C
RM 160-214	W	RM 164-225	NC
RM 214-225	N		

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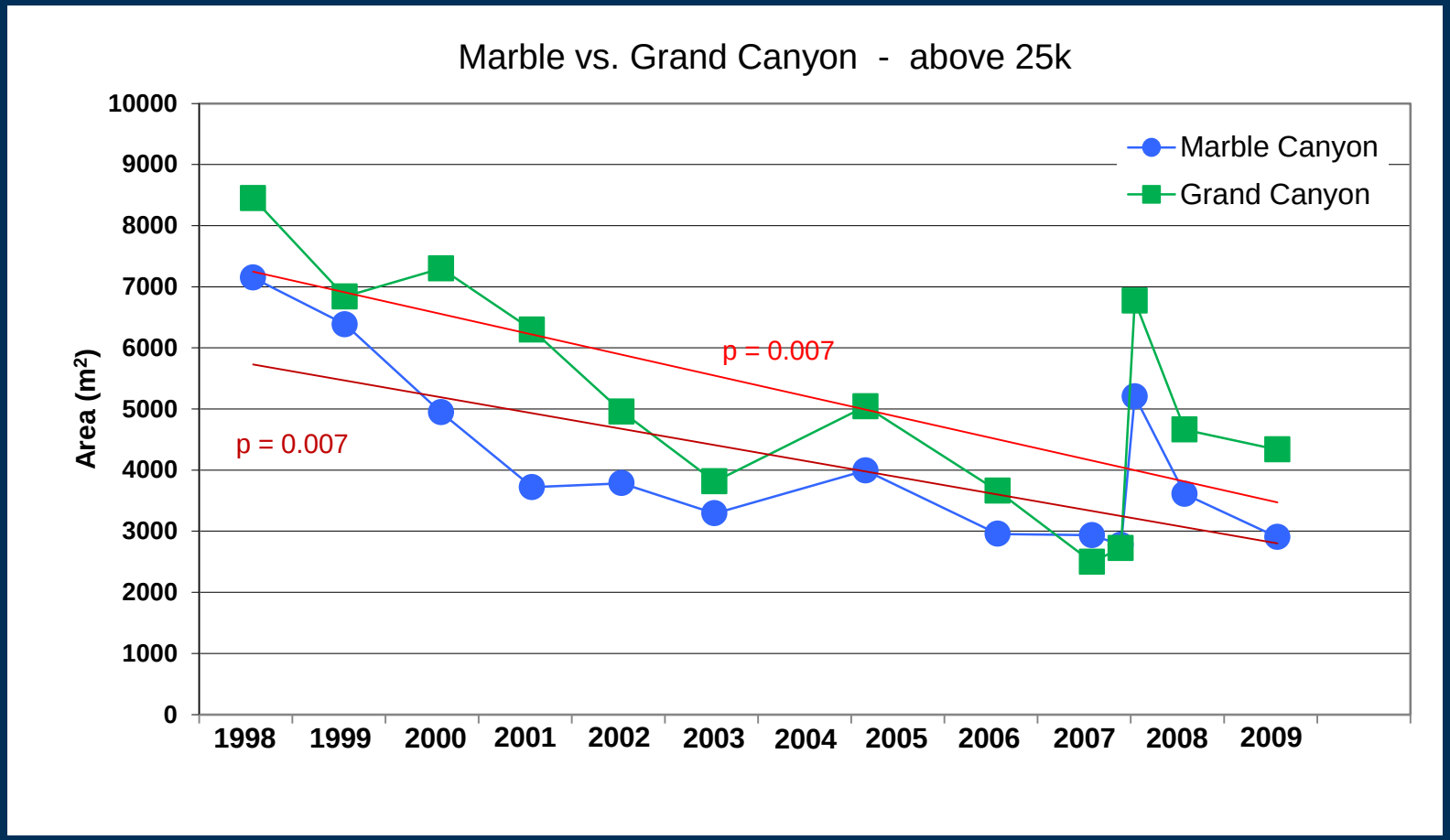

Total amount of campsite area above and below LCR – sum of areas for all sites (MC n=11, GC n=18). Does not include sites added in 2002, or 8l

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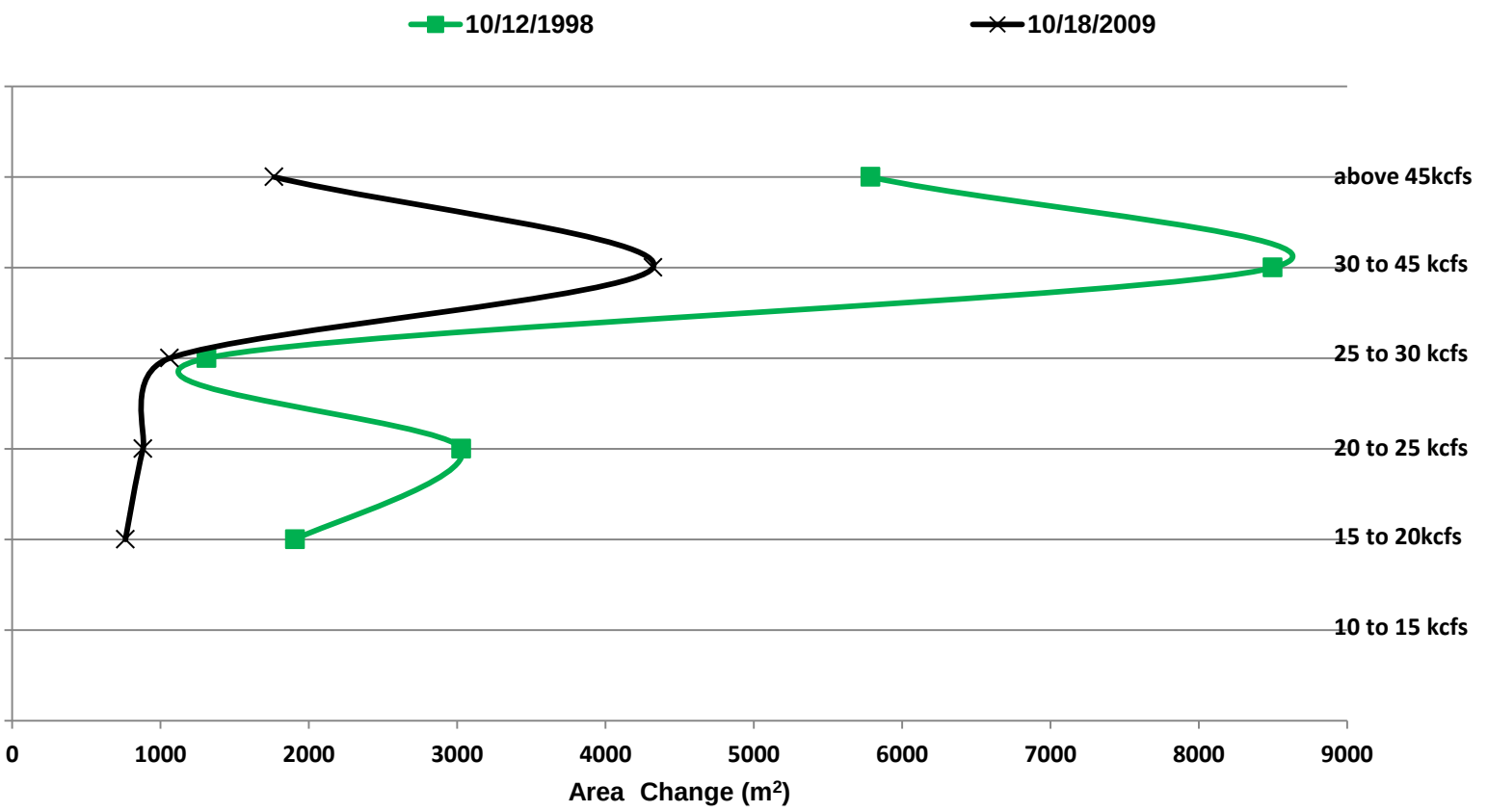
30 Mille Camp

202 Mile Camp

Total Campable Area by Elevation



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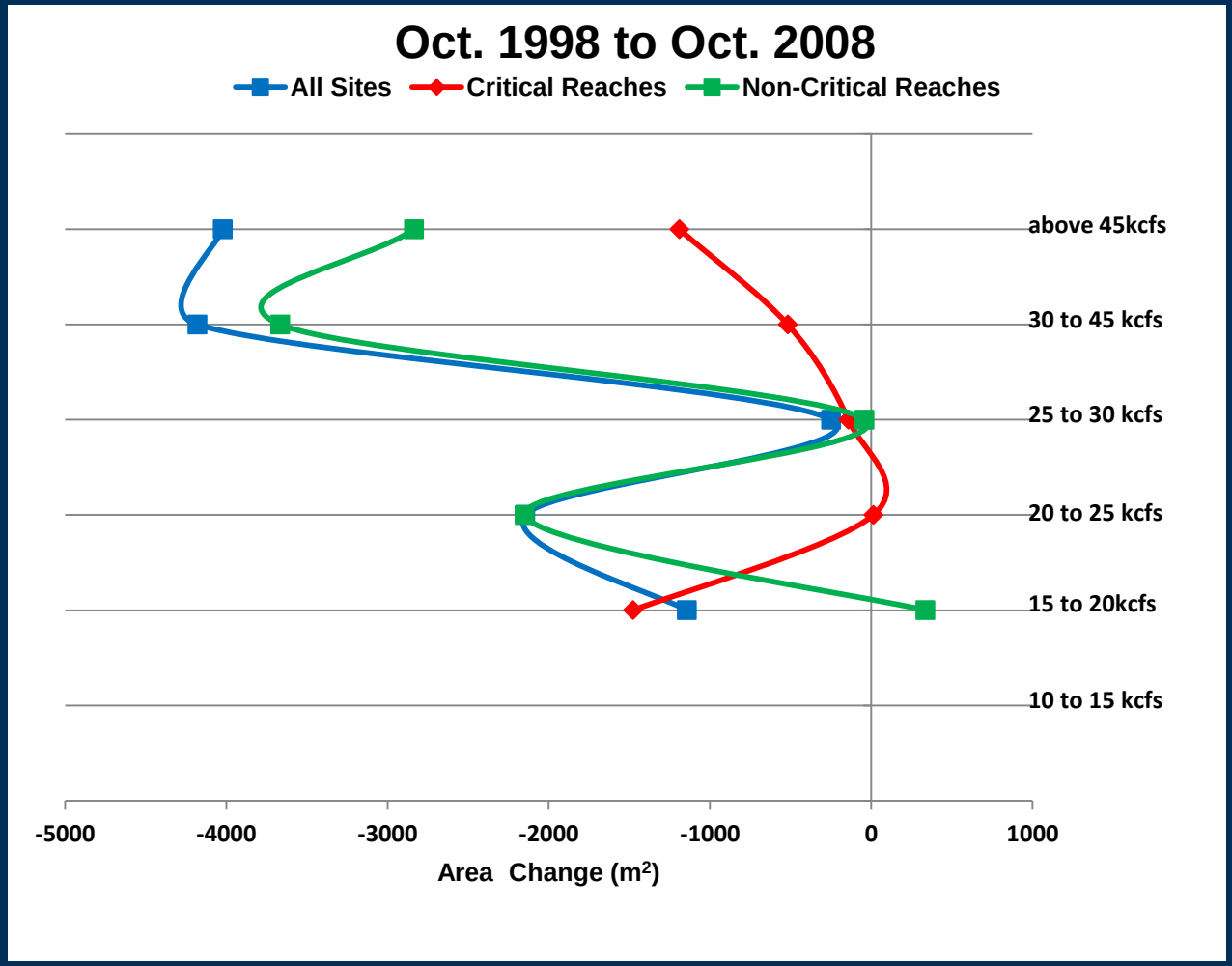

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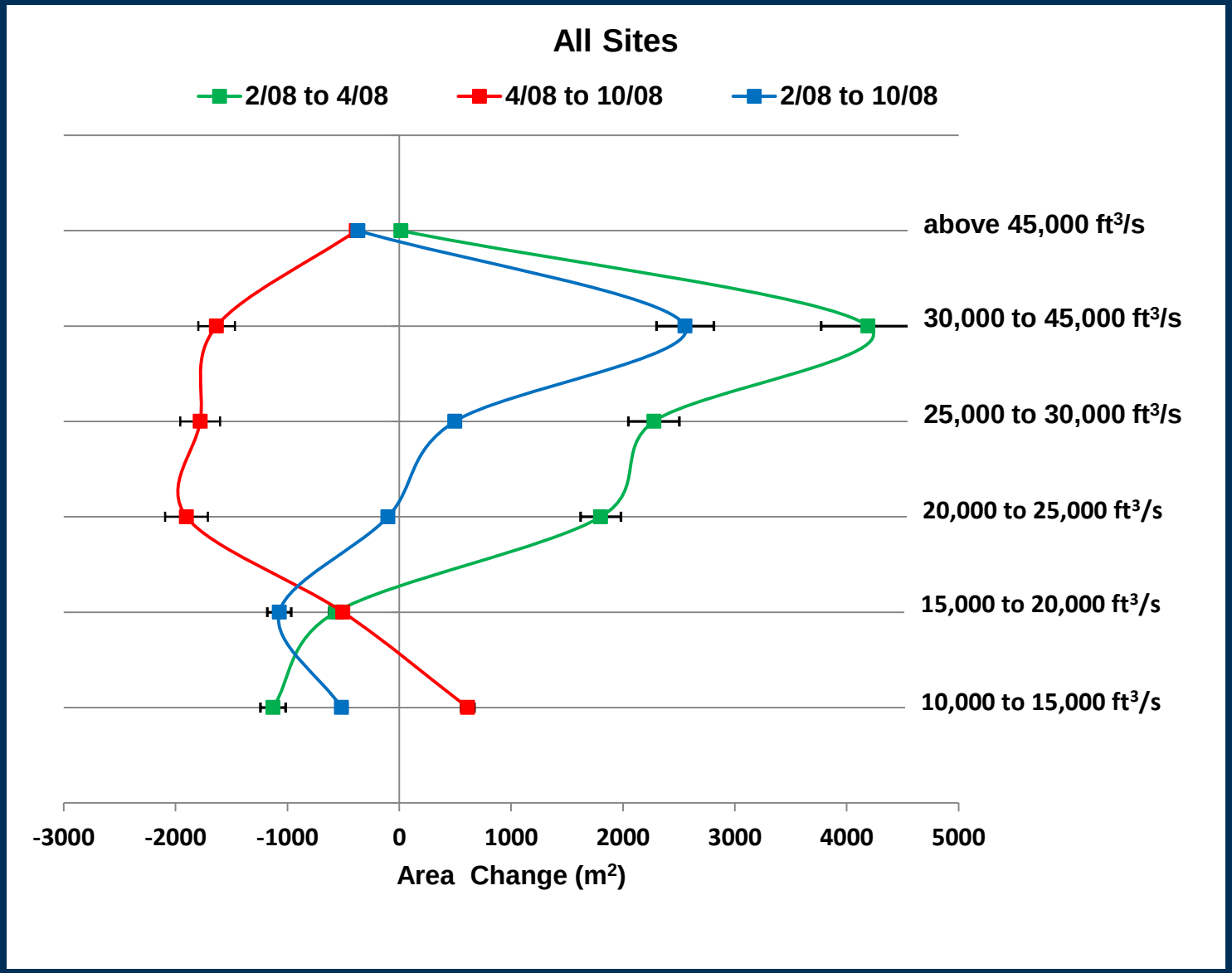
Preliminary Data subject to change – do not cite



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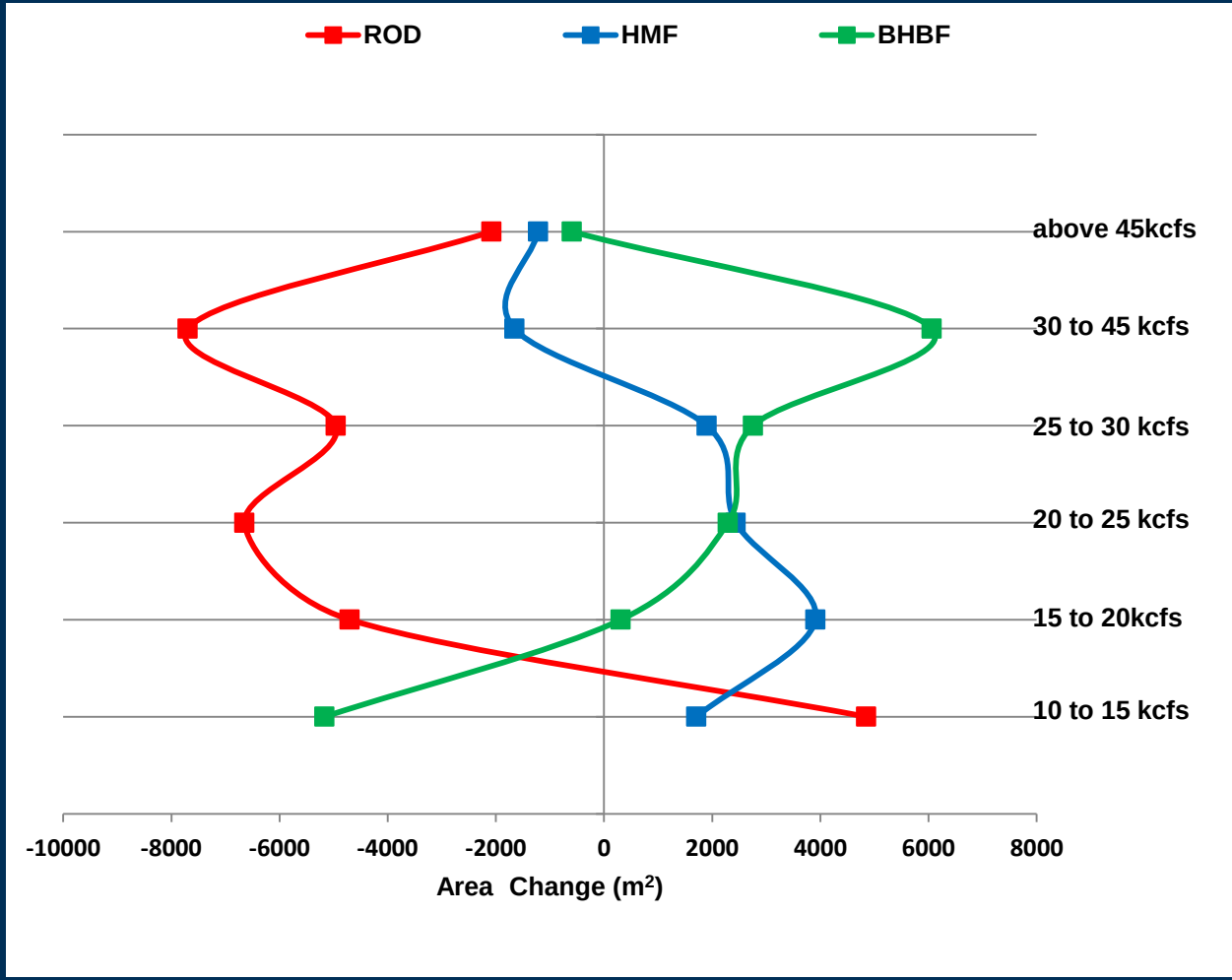

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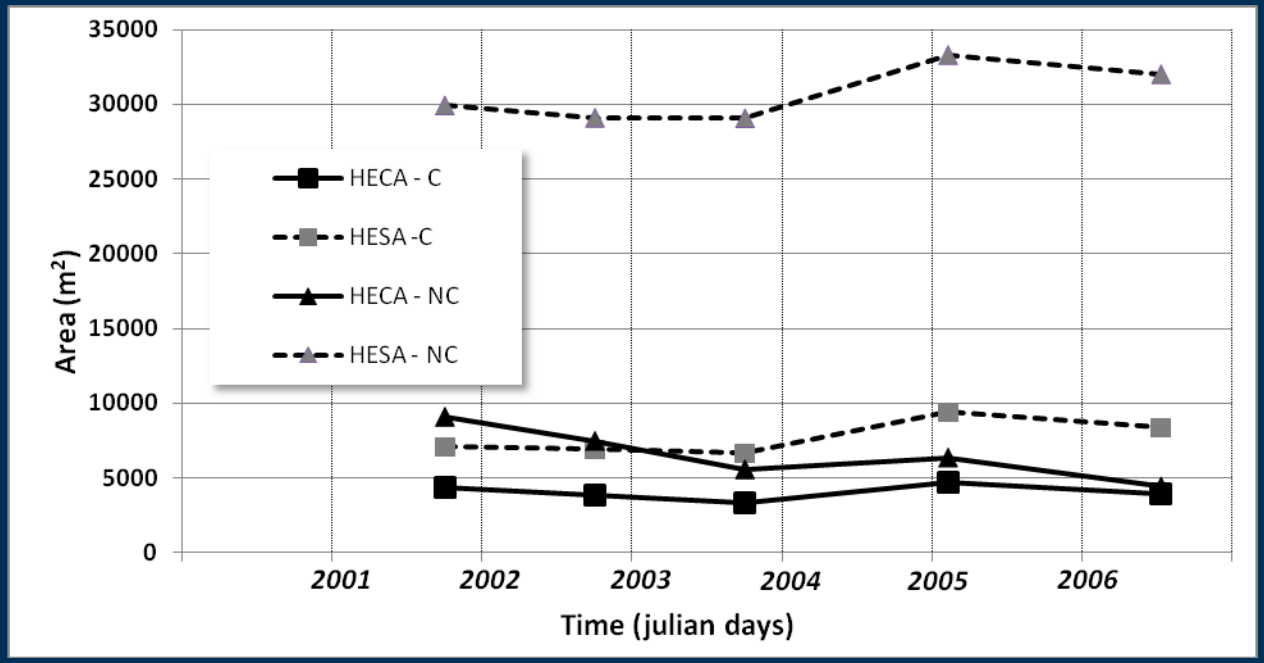

Are changes in campsite area correlated with changes in sand bar area?

Yes in Critical Reaches, No in Non-Critical

Null hypothesis = no correlation between campsite and sandbar area

Kendall correlation coefficients:

Critical Reaches (t=0.8, p= 0.084, t < p therefore reject null hypothesis)

Non-Critical reaches (t=0, p=0.6, t > p therefore accept null hypothesis).

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Campsite Area just one attribute.

9.3—Increase the size, quality, and distribution of camping beaches in critical and noncritical reaches in the main stem . . .

So what about distribution and quality?

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Inventories show changes in campsite numbers, distribution

1973 Weeden Inventory = 328 campsites

1985 Brian and Thomas Inventory = 267

209 campsites appear in both inventories

504 campsites in the current campsite atlas, of which 310 are considered current camps by NPS

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Campsite Quality

Stewart (2002) documented two primary attributes important to campsite quality:

1. **Campsite size**
2. **Shade**

Other factors:

- **Vegetation, up to a point (shade, privacy)**
- **boat parking/ mooring attributes**
- **access**

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Nautiloid, 35.1L

July 1973

07/21/2007

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South Canyon Camp, 31.9R

July 1973

07/21/2007

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South Canyon Camp, 31.9R

July 1973

07/21/2007

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Upper Rattlesnake, 74.6R

July 1973

04/15/2009

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Schist Camp, 96.5L

July 1973

07/05/2007

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186.4 Mile Camp, 186.4L

July 1973

08/01/2007

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19.4 Mile Camp
19.4L

July 1973

07/20/2007

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No Name 74.8, 74.8L

July 1973

07/19/2008

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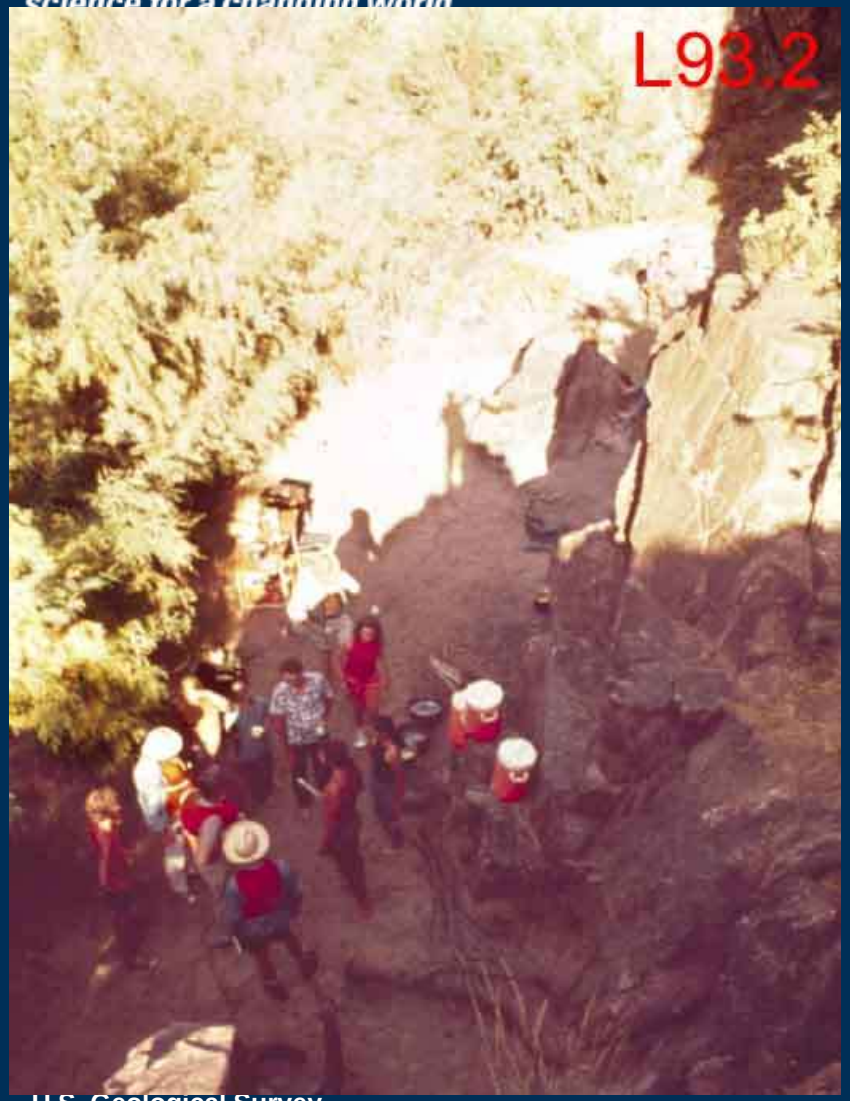
Granite, 93.8L



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July 1973

10/18/2009

No Name 182.0

July 1973

07/27/2008

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170.4 Mile Camp, 170.4L

July 1973

10/26/2007

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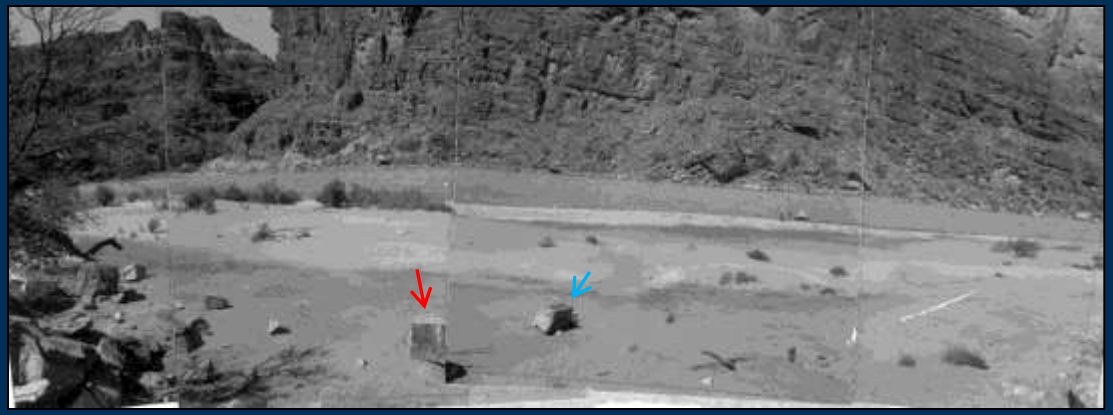
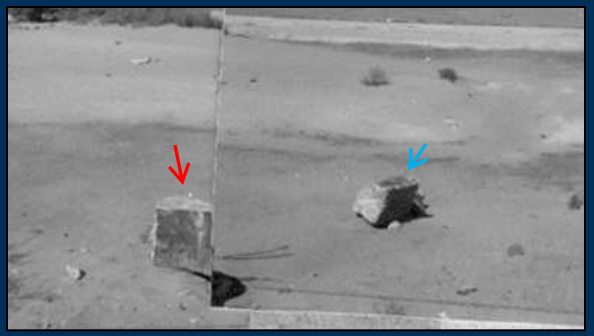
Nevills Rapid, RM 76.10L: 1984-2008 comparison



August 18, 1984 (~12,800 ft^3/s)



1130 April 4, 2008
(~12,800 ft^3/s)

1700 May 20, 2008
(~13,700 ft^3/s)

Changes in Sand Bars and Vegetation

RM 76.10 L (Nevills Rapid)

			Area of Sand		
Year	Discharge (ft^3/s)	Below 25,000 ft^3/s	25,000-50,000 ft^3/s	Above 50,000 ft^3/s	Vegetation
1974	23,000 ft^3/s	Cannot tell *	Cannot tell *	Cannot tell *	Little less
August 1984	40,000 ft^3/s	More	More	More	Less
August 1985	28,000 ft^3/s				
January 1986	16,000 ft^3/s	Same	Same	Same	Same
April 2008	12,800 ft^3/s	Less	Less	Less	More
May 2008	13,700 ft^3/s	Less	Less	Less	More

* There seems to be more new sand in 1985 photo but with no good reference point it is difficult to compare entire sand area for these years.

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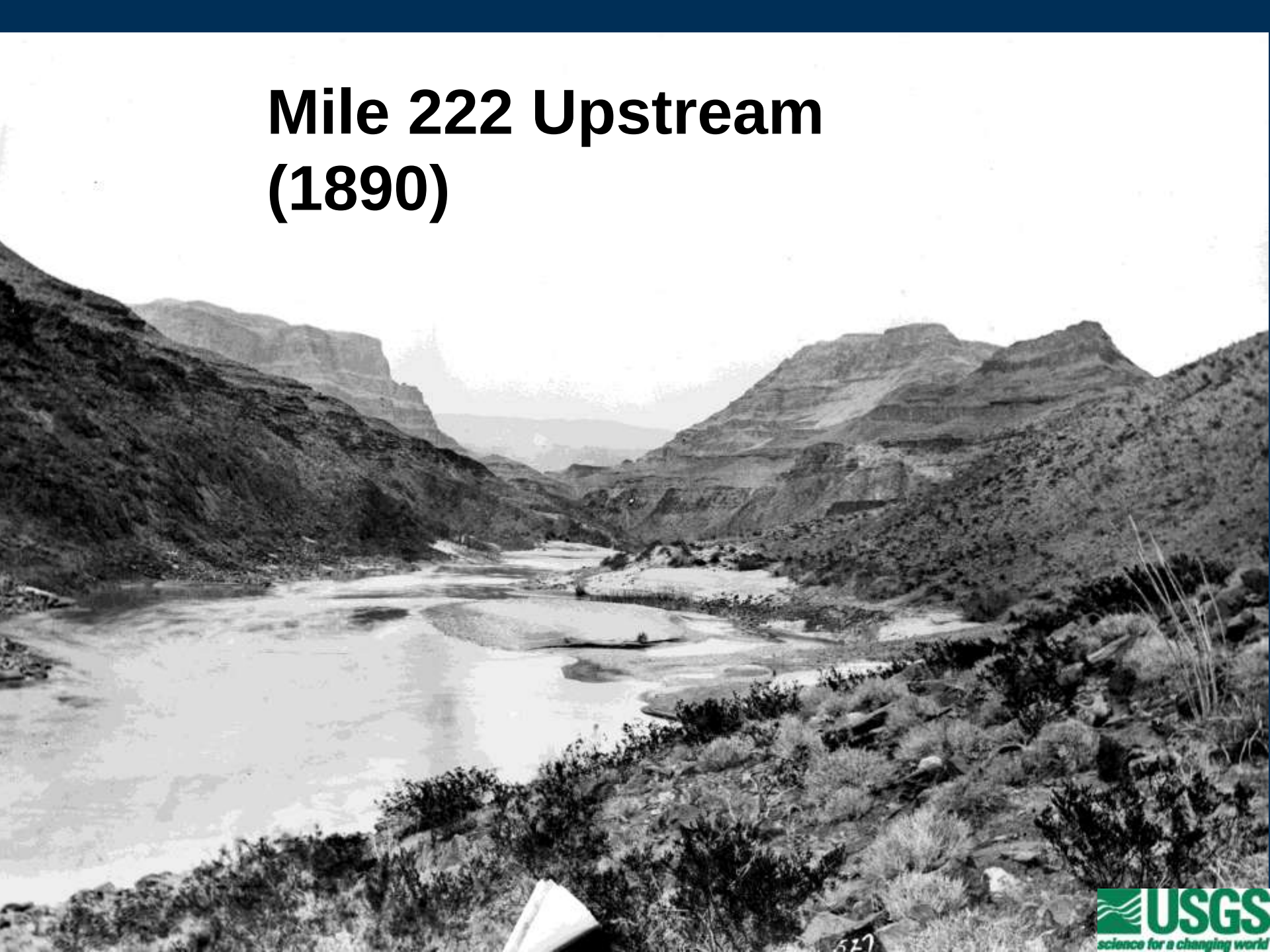
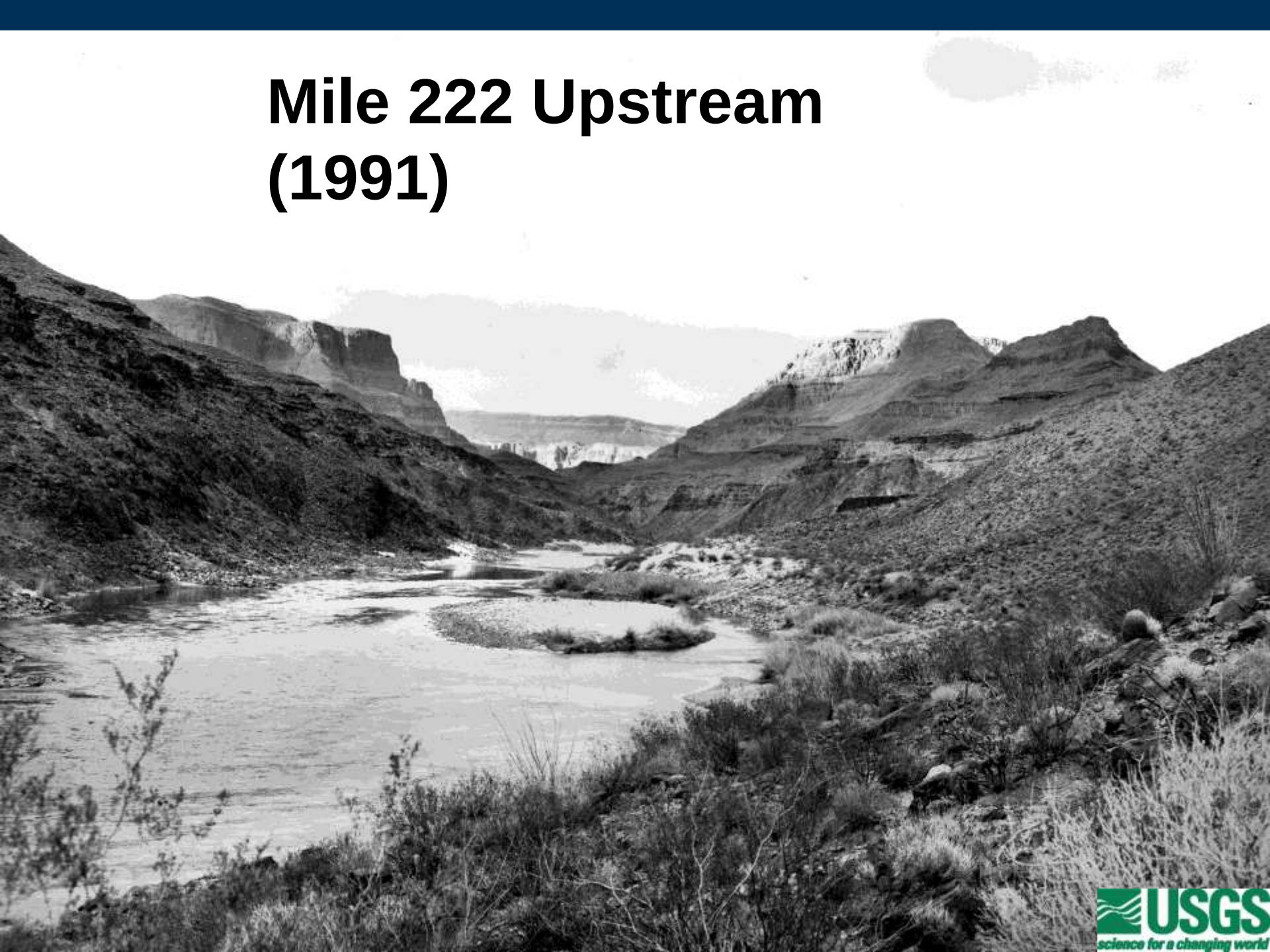
Mile 222 Upstream (1890)



Mile 222 Upstream (1991)



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Mile 222 Upstream (2010)

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Preliminary Results from comparison of 1990/91-2010/11

- The old high-water zone is disintegrating
- New high-water zone development continues
- Some new tamarisk observed, but increases in size of existing trees is more prominent
- Native riparian species are increasing
- The riparian assemblage now is typical of regulated rivers in the western United States

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Hualapai Acres, 194 Mile

2002

2009

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No Name 119.6

July 1973

07/22/2008

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119 Mile Camp, 1996 vs. 2007

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20 Mile Camp
20.3L

July 1973

07/20/2007

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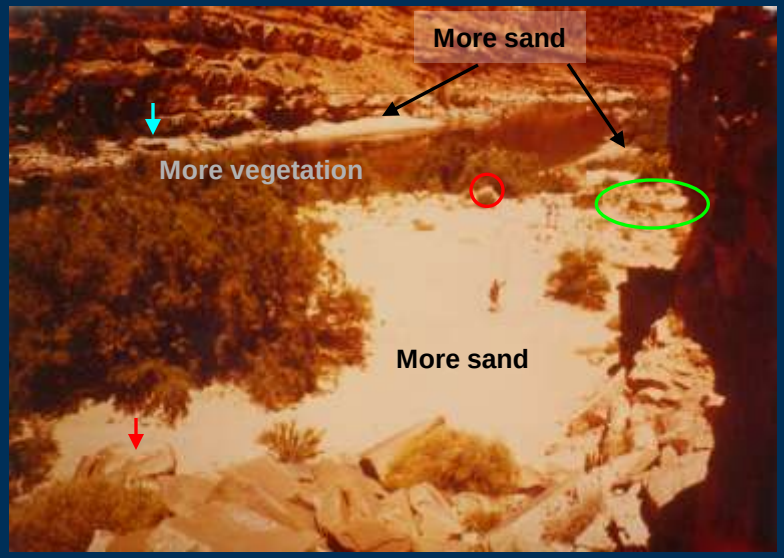
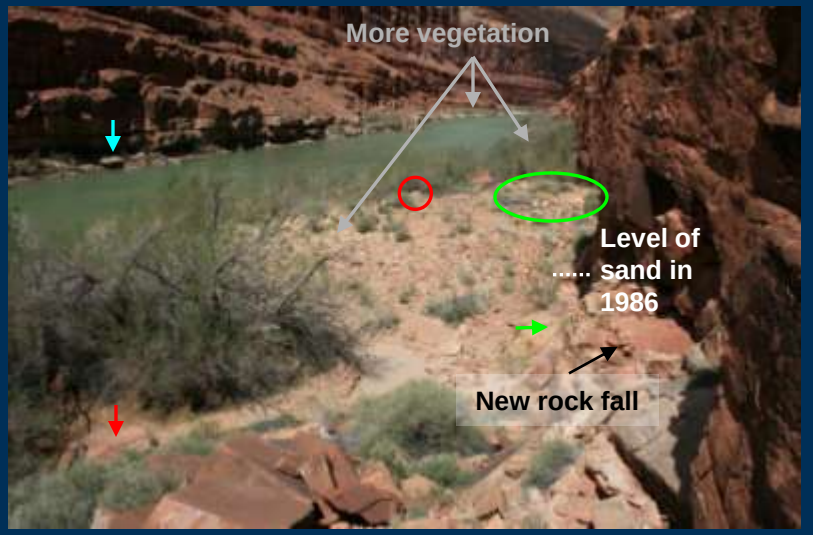
20 Mile Camp RM 20.20L: 1974, 1986 and 2008 comparison



1974 (lower than 1986)

1430 January 14, 1986 (~4,500 ft^3/s)



1230 March 30, 2008 (~7,600 ft^3/s)

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Campsites also being reduced by debris flows and erosion

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Sept. 2006: single storm event

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Above Fossil, 125.0L

July 1973

10/24/02007

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Take home points

- Campsite area has declined 1998-2009 (MLFF)
- High flows temporarily increase campable area
- Campable area has declined less in critical reaches than non critical reaches
- Vegetation encroachment appears to be driving campable area decrease, mainly in NC reaches
- Human use contributes to preserving open camps
- Riparian vegetation growth reflects lack of flood disturbance, relatively stable flows
- AMP management objective for camp site size and quality not achieved

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Questions?